Uniroyal expands epi facility

Uniroyal Technology Corp (Sarasota, FL, USA) has completed build-out of the epi facility at its Uniroyal Optoelectronics (UOE) fab in Tampa, FL, USA for high-brightness LEDs (pictured below). It began construction on the remaining 33,000 ft^2 of the 77,000 ft^2 facility in November 2000. The associated R&D facility is also in the final stages of construction.

UOE also received three new MOCVD reactors for making blue and green HB-LEDs (one of which is in the final phase of materials testing): one for R&D; and two to increase the number of reactors for blue and green HB-LEDs to six.

* According to Strategies Unlimited, the HBLED market grew 54% to US$1.2bn in 2000 and should triple by 2005.

* Uniroyal has appointed David C Miller PhD as president of UOE. Previously, Miller was president of Litton Systems' Airtron Division, worked at General Electric Research Laboratories (Schenectady, NY, USA), and was a member of the technical staff at Bell Labs (where he conducted research involving materials science, including LEDs).

LumiLeds launches high-brightness LEDs

At *Lightfair 2001* in Las Vegas, NV, USA, **LumiLeds Lighting** unveiled its Luxeon line of high-brightness LEDs (designed for high-power light output, with a large die and submount configuration allowing safe operation at currents of 350-700 mA). The line includes:

- ***Luxeon Star***, a single light source with or without optics;
- ***Luxeon Ring*** of 6 or 12 white Luxeon sources with optics and up to 194 lumens of white light; and
- ***Luxeon Flood,*** a small board with densely populated Luxeon sources giving up to 324 lumens of white light.

Luxeon cyan LEDs (the core element in creating white light) show less than 20% degradation after 50,000 hours.

* In June LumiLeds Lighting announced a significant extension of a strategic partnership, combining its Luxeon H&LED based light sources with the LCD backlight manufacturing of Wooyoung Co Ltd of Korea. The target markets include LCD monitors and TVs.

Volume production of high-power violet lasers

Nichia Corp (Tokushima, Japan) the only commercial supplier of InGaN lasers - is moving into volume production of its NLHV3000 series of high-power violet InGaN lasers. These have 30 mW maximum optical power output and 405 nm peak wavelength (about two-thirds the 650 nm wavelength of current red DVD lasers, so they could possibly increase data storage capacity five-fold). The increased optical power output enables not only reading of data but also writing of data.

Nichia demonstrated the first room-temperature pulsed InGaN violet laser in 1995 and began commercial sales in 1999. Sampling of 440 nm InGaN blue lasers followed in 2001.

* Osram Opto Semiconductors' (Regensburg, Germany) says it has succeeded in "repulsing" the Preliminary Injunction filed by Nichia in December 1999 against Osram in Tokyo to prohibit importation, selling and offering of Osram's white LEDs in Japan. This alleged infringement of Japanese Patent 2927279, which protects the use of yttrium garnet as phosphor for conversion of the light of a blue-emitting InGaN LED. Osram says it is using a different material.

Nichia has now followed the judge's recommendation to withdraw the complaint.

Vishay acquires Infineon's infrared business

Following the sale of its consumer electronics to Micronas last November, **Infineon Technologies** AG (Munich, Germany) is continuing to concentrate its wireline activities and expand strategic core activities in local area networks (LAN), wide area networks **(WAN)** and network access by selling its infrared components business (total workforce 1,200; fiscal-2000 revenues US$133m) for about US$120m to **Vishay Intertechnology Inc (Malvern,** PA, USA).

This includes development, marketing and distribution activities at the HQ in San Jose, CA, USA for products including optocouplers and solid-state relays, IrDT (Infrared Data Transmission) modules, DAA (Data Access Arrangements) kits and custom opto modules, as well as the newly founded production joint venture in Malaysia, Infineon Technologies Krubong Shd (of which Vishay will initially own 19%, with the remaining shares transfered during 2002).

* In July Infineon proceeded with its public offering of 60m newly-issued, raising €1.5bn (and lowering Siemens' stake in Infineon from 56% to just over the target of 50%).

InP/GaN videos

Two 2.5 hr videos of the *InP 101* and *GaN 101* workshops at Gorham's Compound ***Semiconductor Outlook 2001*** conference in San Diego, CA, USA in February are now available from *CompoundSemi* **Online** for US$495 each (or US$425 for ***Compound Semiconductor Outlook 2001*** attendees).

Brief News - Taiwan

Epitech Optoelectronics (Hsinchu, Taiwan) has launched the UBA series AlInGaN LED dice. This offers true blue emission with a dominant wavelength of 470 and 465 nm (for application with red and green LED to produce white LEDs) with an operating current of 20 mA, luminous intensity 3 mcd, minimum reverse voltage 5 V, and forward voltage 3.6 V (typical) and 4.0 V (maximum).

The dice measure 0.30×0.30 mm, with a thickness of 80 µm. The emitting area measures 0.225×0.225 mm. The bonding area has a diameter of 3 µm.

Kingmax Optoelectronics Inc (Hsinchu, Taiwan) is developing a 1310 nm VCSEL (joining its 850, 780 and 650 nm VCSELs). It is processing its own epiwafers using three MOCVD machines primarily for 3" wafer processing – a total monthly capacity of 600 wafers. New equipment will increase capacity to 1,200 wafers per month.

Kingmax is also sampling PIN diodes to potential customers.

Hotung Venture Capital Group – Taiwan's third-largest VC group after WI Technology Fund Group and Pacific Venture Group – is currently raising a fund of NT$1bn (US$30.3m) to finance optoelectronics, telecoms, biotech, and IC design start-ups.

Of opto funds, 40% will go to North America and Israel, 40% to Taiwan, and 20% to mainland China.

Telecoms funds will focus on broadband access, opto communications, and datacoms technologies.

UEC producing epiwafers for lasers & 1.3 µm HB-LEDs

United Epitaxy Company Ltd (Hsinchu, Taiwan) has started mass production of epiwafers for:

- AlGaAs VCSELs of wavelengths from 780-850 nm in both ion-implant and oxide-confined form. The 10 µm-aperture 850 nm AlGaAs oxide-confined VCSEL has a threshold current of about 1 mA, slope efficiency of 0.3 W/A, and resistance of about 35 W.
- 1310 nm Fabry-Perot lasers with a 3 µm stripe width and 300 µm cavity length and a typical threshold current of 12 mA, operating current at 5 mW of about 25 mA, slope efficiency of 0.37 W/A, and characteristic temperature of over 85°C.
- 1310 nm high-brightness LEDs.

* UEC's new Plant 3 in the Tainan Science-Based Industrial Park is starting volume production of ultra-high-brightness (UHB) AlGaInP LED chips (for applications including traffic lights, automobile taillights, outdoor displays, safety/emergency lights, decorative lighting, backlights of cellular phones, indicator lamps of electronic devices and toys).

UEC says it has lowered UHB-LED production costs to NT$0.1-0.2 per chip, making it reasonably competitive with the <NT$0.1 per chip for traditional LEDs.

UEC plans to install 80-100 MOCVD reactors to raise UHB-LED capacity to 1bn chips per month over the next five years, reckoning that world UHB-LED demand will reach 2.5bn chips by 2005.

MEMSCAP and ORC collaborate

To focus on active optical components for the metropolitan and access layers of the optical network, microsystems company **MEMSCAP** (St Ismier, France) has established the subsidiary **MEMSCAP Oy** (under director Mihail Dumitrescu), co-located with **Optoelectronics Research Centre** (ORC) in Tampere, Finland.

To source low-cost optical components for short-haul polymethyl methacrylate (PMMA) plastic optical fibre (POF) networking, it is licensing technology from ORC. MEMSCAP has also announced the availability of 650 nm RC-LEDs and 690 nm VCSELs, which are made in low volume using ORC's fab. "*Benefits include operation at the fibre's attenuation minimum, flexibility in alignment, a 30% coupling efficiency without any supplementary optics*," says Dumitrescu. "*These RC-LEDs have a high efficiency at 9.5% and hold the world record in speed for red wavelength range spontaneous emitters, achieving error-free transmission rates beyond 622 Mbps.*" The red VCSEL can be extended to 670 and 650 nm and offer good compatibility with PMMA POF.

Also being jointly developed are products for perfluorinated (PF) POF at 1000 nm and silica glass fibre at 1300 nm, including 1.3 µm VCSELs and MEMS-based tunable VCSELs for WDM (for commercialisation in 2002).

MEMSCAP will have access to ORC facilities and equipment for testing, characterisation and production, intending to ramp up additional internal capacity for high-volume production over the next 18 months.

* MEMSCAP is to establish a **MEMSCAP Japan** subsidiary in Tokyo, focusing on selling MEMS-based wireless component designs such as RF switches and optical components, including micromirror-based cross-connect switches and sources.

It has also set up relationships with three software distributors in China, Korea and Australia and plans to offer software training seminars throughout the region.

MEMSCAP already has two software distributors in Japan, one in Taiwan and one in India. Asia is expected to represent more than 30% of MEMSCAP's total revenues this year.

Single-mode 1550 nm laser power doubled

Using its WaveHarp Distributed Feedback (DFB) lasers (which emit high power in a narrow spectral band), **Princeton Lightwave Inc** (Cranbury, NJ, USA) has claimed a record 340 mW of output power from a 1550 nm DFB laser coupled into a single-mode fibre (more than twice the previous record of 165 mW).

WaveHarp can reduce the need for amplifiers in metro DWDM networks, but it can also be used in free-space optical networks. While transmitters for free-space optical applications have been shifting into the 1500 nm eye-safe wavelength range, they have been limited to one wavelength channel for transmission of the signal. Princeton Lightwave's WaveHarp products are configured with 4 or 8 channels for transmission and a corresponding number of channels for reception.

Picolig ht's 10 Gb/s VCSEL transponder

After shipping VCSEL-based **products** since **1999, Picolight** (Boulder, CO, USA) has introduced its first 10 Gb/s 300-pin VCSEL-based short-wavelength optical transponder for 10 Gigabit Ethernet and OC-192 SONET networks. It is compact and with low power dissipation for very short reach (VSR) broadband fibre-optic applications.

Picolight was founded in **1995** by CTO and Chairman Jack L Jewell as a spin-out of Vixel Corp (originally Photonics Research Inc and one of the earliest VCSEL developers), which Jewell co-founded in 1991.

* Picolight has entered volume production of the first in its MAGNUS family of 850 nm oxide VCSEL-based 32 Gb/s (1 Z-channel x 2.7 Gb/s) parallel optical interconnect transceiver modules and the first transceiver to combine the speed of parallel optics with the convenience of low-cost, snap-on connector pluggability (for easy integration on backplane circuit cards of large switches).

The pre-tested, prequalified 32 Gb/s modules can be dropped into place later in the build cycle, avoiding potential optical damage from the wave-soldering and washing steps of standard assembly techniques. Connectorization also allows testing of PCBs at the BGA connector pins before optics installation, leading to improved final assembly yields.

* According to **Cahners In-Stat,** the transition to 10 Gb/s interconnect and 100 Gb/s DWDM links has increased the amount of data that **must be** moved inside large enterprise switches.

First 10 Gb/s VCSEL-based 1310 nm serial transponder

In Q3/2001 Cielo Communications (Broomfield, CO, USA) is sampling to development partners the industry's first 10 Gb/s VCSEL-based 13 10 nm serial transponder for high-bandwidth, dense optical interconnects.

The module is fully compliant with:

- the OIF-SFI4-01.0 implementation agreement for a common electrical interface between SONET framer and SerDes parts for OC-192 interfaces with versions that support OIF, Ethernet, SONET/SDH and Fibre Channel standards for 10 Gb/s 1310 nm optical interconnects;
- the 200-pin Small Footprint OC-192 Transponder Multi-Source Agreement to enable rapid design-in for optical system developers.

* Since July Cielo has been producing a 850 nm 10 Gb/s VCSEL-based serial transponder (first sampled in late March) for OC-192 Very Short Reach (VSR), 10 Gigabit Ethernet and proprietary backplane interconnects up to 300 m in length.

Other products for VSR use either **13** 10 nm serial or 850 nm parallel solutions:

- **13** 10 nm serial solutions offers architectural simplicity, but suffers from high power consumption and the high packaging costs of more expensive 1310 nm edge-emitter lasers and single-mode optics;
- 850 nm parallel solutions have low power dissipation and the lower costs of VCSELs and multi-mode optics, but involve more complicated interconnect designs using multiple devices and parallel optic components.

The transponder ***"takes the best from both worlds by offering a high-speed serial solution over MMF that is less expensive, requires less than half the power, and is half the size of current alternatives".***

First 635 nm red lasers with near-circular beam

Hitachi Semiconductor has developed what it claims are the industry's first 635 nm red lasers with a nearly circular light beam - the "MARU Beam" series with an aspect ratio (beam height/width) of 1.2.

Hitachi uses a self-aligned refractive index (SRI) structure in combination with an optimised strained multi-quantum well structure. SRI is a wave-path structure in which a parallel-direction block layer is formed during crystal growth.

The active layer is inserted in a cladding layer of different refractive index. The perpendicular cladding layer and the parallel block layer are formed simultaneously, so the width of each layer can be controlled precisely, ensuring a low aspect ratio.

The first products are 5 mW sources - the HL6335G series (in a 9 mm package) and HL6340MG series (in a 5.6 mm package), with an operating current of just 25 mA (available in Q3/2001).

"Our goal is to continue to develop higher output versions of MARU Beam devices and ultimately achieve a fully circular beam," says Paul Patterson, director of the wireless, lightwave and power business unit.

Bandwidth9 collaborates with Corning

Bandwidth9 (Fremont, CA, USA) which produces the world's only monolithically grown, tunable VCSELs has activated a **fourth 2"** MBE reactor, enabling growth capacity of over 100,000 gross die per month. It has also experienced favourable yield advancements, as it continues to sample prototypes of its first product, the MetroFlex tunable OC-48 transmitter subsystem.

* Bandwidth9 is working with Coming **Inc** (Corning, NY, USA) to explore combined solutions based **on** Corning MetroCor optical fibre (compatible with single-mode fibres, and which compensates for this dispersion, reducing or eliminating the need for discrete dispersion compensation components) and Bandwidth9's MetroFlex metro-optimized tunable optical transmitter module that reduce costs and magnify deployment flexibility for metro optical carriers.

Initial performance testing results reveal that the two products maintain excellent optical signal quality over metro application distances.

* Bandwidth9 has appointed the following new members to its technical advisory board:

- Dr Tingye Li (former division manager in the Communication Infrastructure Research Laboratory of AT&T Laboratories, and considered the "Founder of WDM" for his pioneering research on wavelength division multiplexed transmission systems).
- Dr Kenichi Iga (whose career spans more than 30 years of researching fiber optics, lasers, and micro-optics at the Tokyo Institute of Technology, and considered the "Father of Surface Emitting Lasers").

Intense Photonics secures £7.75m; acquires fab

Intense Photonics Ltd (Glasgow, Scotland, UK) has secured £7.75m (US$11 m) of first-round equity financing (from venture capital company 3i and ACT Capital Partners), to commercialize its proprietary quantum well intermixing (QWI) fabrication process for photonic integrated circuits (PICs), which has already been trialled on a wide variety of device designs including lasers, amplifiers, filters and switches.

It has already announced its first PIC, which exploits QWI's integration capability to create a high-yield chip for DWDM. (It will also demonstrate a prototype PIC building block at September's *ECOC* exhibition.)

"Rapid change in fiber optic technologies has introduced considerable risk into the broadband communications market", says CEO David Lockwood. "Our technology addresses this by providing a proven technology for long-term evolution, which is capable of delivering gradual enhancements and step-function changes, according to individual needs."

The market for optical components used in DWDM systems is forecast to be US$4.5bn in 2001, and to grow to US$13.6bn by 2004, according to RHK Inc. RHK's Director of Optical Components research, John Lively, believes there are two key trends underlying this market growth: the migration from passive to active devices, and the replacement of discrete single-function components with monolithic multi-function components. Both are fundamental to Intense Photonics, which believes it can capture 20% of its target component sectors within four years.

QWI technology allows the bandgap energy to be controlled such that multiple optical communications functions can be integrated on a monolithic chip.

The result is a long-life platform for developing solutions to the transceiver, switching and routing subsystems for DWDM backbones, and future all-optical networks, which can be fabricated and packaged with ease.

*A week later Intense Photonics acquired DuPont Photomasks' fab at Hamilton International Technology Park, High Blantyre, Scotland – which is only three years old and has over 360 m^2 of class 1 clean-room space and a further 1200m^2 of manufacturing and office areas.

It will transfer equipment from its labs on the Kelvin Campus, West of Scotland Science Park (Glasgow Scotland, UK) and expects to have the site operational for development purposes in September. Further equipment has been ordered and will be installed throughout, 2001.

The facility will house around 50 Staff in the short term and will grow to 80 by medium term.

10 Gigabit Ethernet form-factor standard extended

IBM Microelectronics, Mitsubishi Electric, Pine Photonics Communications, Optillion and Tyco Electronics have joined a multi-source agreement (MSA) group led by Agere Systems Inc and Agilent Technologies Inc (originally announced in March and now known as the "XENPAK" chip-level standard) which supports the proposed IEEE 10 Gigabit Ethernet interoperability standard and specifies a uniform transceiver form-factor, size (36 x 121 x 17.4 mm), connector type and electrical pin-outs.

The MSA covers all four proposed transceiver types (850 nm serial, 1310 nm serial, 1310 nm WWDM, 1550 nm serial).

*The first products from Optillion (founded in 1999 in Kista, Sweden) are fibre-optic transceivers for 10 Gb/s Ethernet at distances of 10 and 40 km. Prototypes will be launched in Q3/2001. Optillion presented a module adapted to meet the new product standard at May's *Networld+Interop* trade fair in Las Vegas, NV IJSA.

US$6m seed funding for QD lasers

Quantum dot laser developer Zia Laser Inc (Albuquerque, NM, USA) has received US$6m in seed round funding (from Prism Venture Partners and RWI Group). It will use it for several key hires, building corporate infrastructure and expanding product development.

QD lasers exhibit increased wavelength tunability and improved electronic properties, thereby offering the potential to provide optical networking subsystems with superior performance at a fraction of the present cost.

Zia was founded by faculty members and research scientists at the Center for High Technology Materials at the University of New Mexico. Interim CEO Thomas M Brennan was previously co-founder and president of Micro-Optical Devices (acquired by EMCORE in 1997) and vp and General Manager of Emcore Photovoltaics (Albuquerque, NM, USA).

William M Seifert (General Partner, Prism Venture Partners) and William R Baumel (General Partner, RWI Group) will join the company's board of directors.

First undersea Raman pump laser

Agere Systems (Allentown, PA, USA) is sampling the industry's first undersea pump laser for Raman amplification in ultra-high-capacity submarine optical networks (for production in early 2002).

The SLR250 is an uncooled, high-power InP-based Fabry-Perot pump laser which uses a Panda polarization maintaining fibre and is stabilized with an external fiber Bragg grating. It is available in 1480 and other 14xx nm wavelengths and supports a fibre output power of up to 250 mW with a drive current < 1 A and an operating voltage < 2.5 V.

Agere was previously also the first company to announce both 1480 and 980 nm pump lasers for erbium-doped undersea amplifiers (in the guise of Lucent Technologies).

NASA selects Tecstar to develop 40%-efficient concentrator cell

Tecstar Inc (City of Industry, CA, USA) has been selected by NASA Glen Research Center to develop a 40%-efficient light-weight Concentrator Solar Cell.

"These cells will enable more than 1000 W/kg specific power, with techniques that are employed to significantly reduce mass and cost," says vp for Marketing and Sales Patrick L Park.

Tecstar has appointed Dr Charlie Chu as Principal Investigator. Tecstar has partnered with The California Institute of Technology (CALTECH), Dr Harry Atwater (as Co-Investigator); and with National Renewable Energy Laboratory (NREL) through Dr Mark Wanlass (also as Co-Investigator). This effort is planned to span 36 months and will investigate both the device physics and advanced structure designs, and will deliver prototype solar cells for testing.

* Tecstar has started full-scale production of its TEC 3i Third Generation-Multi-junction solar cell.

"TEC 3i offers solar array and satellite integrators a key enabling technology yielding satellite end-of-life (EOL) performance and significant reductions in manufacturing costs previously unattainable in the market," indicated Tom Cadwell President & CEO.

"Key to this success is our (26.5% and 86% end of power remaining, p/p_o at $1x10^{15}$ MeV) new record for radiation performance for solar cells of this very large size and our patented monolithically grown By-pass Diode," which enables superior solar panel performance and has demonstrated operation to 100,000 extreme shadow cycles.

TEC 3i technology is also offered at any level of integration: epi, cells, cell assemblies or complete solar panels ready for satellite array integration.

First 10 Gb/s 1310 nm SEML

While 1310 nm directly modulated Distributed-Feedback (DFB) lasers have been available for some time, **Multiplex Inc** (South Plainfield, NJ, USA) has introduced the MTX310EW - the first commercially available 10 Gb/s 1310 nm short-wavelength electro-absorption modulated laser (SEML) - to extend the fibre bandwidth in the "S" band. (Most EML manufacturers use 1550 nm technology, since EDFAs can only amplify C- and L-band signals in the 1550 nm minimum transmission loss window.)

But in the future Raman amplifiers will be used with 1310 nm SEML transmitters in the S-band, where the near-zero dispersion property of the fibre is used.

Compared to directly modulated DFBs, Multiplex's SEML offers superior signal quality (eye pattern) and is much easier to use.

* Multiplex has appointed Chris Peterson to the position of vp of Sales and Marketing (after 15 years with Mitsubishi Electronics America Inc of Sunnyvale, CA, USA, most recently as vp/deputy GM of the Imaging Communications and Integration Division).

AXT launches 1.55 µm FP lasers

The VCSEL/LD Technologies Division of **AXT Inc** (Fremont, CA, USA) has made available 1550 nm edge-emitting Fabry-Perot (FP) lasers for metropolitan area networks and other medium- and long-haul fibre-optic data transmission in the C-band.

Power output is 10 mW at 85°C and peak linear power is 20 mW. Typical threshold currents are 10 mA and slope efficiencies up to 0.5 mW/mA.

The lasers can be driven to modulation speeds in excess of 2.5 Gb/s for OC-48 transceivers.

President and CEO Morris Young claims that power output exceeds that of most other 1550 nm lasers currently available and efficiency is about 50% better than most (enabling aggressive transceiver designs with fewer cooling concerns).

Technology: Optoelectronics

Bookham's joint venture company QWIP Technologies (Edmonton, Alberta, Canada and Pasadena, CA, USA) is supplying test-grade QWIP detectors, totalling up to US$120,000 in revenues to Microwave Bonding Instruments (Pasadena, CA, USA).

The QWIP detectors will be used in a SBIR Phase II R&D program funded by the United States Air Force for the continued development of its support technology for flip-chip bonding.

Infinite Group Inc (Warwick, RI, USA and Albuquerque, NM, USA) has named Dr Richard Stoltz as Director-Intellectual Property Development for its Infinite Photonics Inc subsidiary (which develops lasers based on its IP GCSEL technology platform for applications including high power pump lasers used for EDFA and Raman amplification, tunable lasers used in optical transmitters and receivers for telecoms, and material processing applications).

Dr Stolz recently retired from Texas Instruments, where he developed broad patents in GaAs, CMOS, BiMOS, and InP.

Developer and manufacturer of innovative active and passive optical components for optical networks Teem Photonics (Grenoble, France) has appointed Herve Hautin (who was formerly plant director at Philips Lighting for two years and at Philips Semiconductors 11 years) as director of manufacturing, as it ramps up production of its splitters and erbium-doped waveguide amplifiers.

National Fiber Optic Engineers Conference

At July's ***National Fiber Optic Engineers Conference*** in Baltimore, MD, USA, Coarse Wavelength Division Multiplexing-based optical subsystem supplier Blaze Network Products Inc (Dublin, CA, USA) said it is sampling its ultra-high bandwidth Inferno-CGSX product line (shipping production units in October), targeting the terabit and petabit switch markets.

is-channel transmit and receive modules integrate CWDM (using VCSELs running at 2.488-3.125 Gb/s) with single 12-channel multi-mode ribbon fibre to create highly parallel optical interconnects, enabling scalable solutions for 100, 120, 150 Gb/s links and beyond.

EMCORE Corp (Somerset, NJ, USA) introduced its new 850 nm 10 Gb/s GaAs photodetector for multi-mode fibre-optics (available with EMCORE's recently introduced 10 Gb/s oxide VCSEL, providing a matched solution for transmit and receive) for Very Short Reach (VSR) applications, which include serial links, Local Area Networks (LANs) for Gigabit Ethernet and Fibre Channel, Infiniband and OC-192.

The photodetector and VCSEL can be easily integrated into transceiver modules because they are optically and mechanically homogeneous. Aperture size is 60 pm, dark current <0.2nA, capacitance typically 0.23 pF, bandwidth 8.5 GHz, and minimum responsivity 0.5 A/W The 10Gb/s VCSEL has an output power range of typically 1 mW and 3 dB bandwidth in excess of 10 GHz.

According to recent data from ElectroniCast Corp, 10 Gb/s datacom transceiver module use will reach US$9bn by 2010. The market will see 7m 10 Gb/s datacom transceiver units by 2005 for VSR interconnects, Infiniband, Fibre Channel/Storage Area Networks and 10 Gb/s Ethernet applications.

Alcatel Optronics (Paris, France) launched the 1906 OFA single-channel optical booster EDFA amplifier, the smallest compact amplifier ($70x90x12 mm^3$), offering high optical output power (for high-bit-rate systems, particularly in metropolitan links and optical crossconnects) and low electrical consumption (<3.5 W).

It is available in a configuration able to reach + 18 dBm (63 mW) optical output power in the C-band (1528-1565 nm) using a single miniaturized internal in-house manufactured 980 nm pump module which maintains the amplifier's low optical noise factor (<5.5 dB typical).

* Alcatel Optronics also presented advanced new components, modules and sub-systems for optical metropolitan networks which allow system manufacturers to achieve significant gains in terms of integration, flexibility and cost reduction:

- a range of ultra compact amplifiers: boosters and pre-amplifiers including a new amplifier featuring exceptional optical output power of + 18 dBm adding functionalities to optimize DWDM metro systems;
- a high-performance 10 Gbit/s optical receiver dedicated to DWDM terrestrial applications;
- a 10 Gbit/s WDM optical interface dedicated to metro applications characterized by its compact size, and its conformity to international interoperability standards between manufacturers (Multi Source Agreement), ensuring easier integration on system boards;
- a miniaturized 1260-l 360 nm DFB integrated laser module with a bit-rate up to 2.5 Gb/s over 40 km. Its easy-to-use "Minidil" package includes a revolutionary cost reducing Silicon Planar technology based submount. This new technology will facilitate the hybridization of active components and passive components.

Pump laser manufacturer Fitel Technologies Inc (Clinton, NJ, USA) and it's parent company, The Furukawa Electric Co Ltd, said it was sampling a series of DFB lasers for WDM transmission systems (with full production at end-2001 at its plant in Chiba, Japan). This includes a series of 1550 nm CW and direct modulated DFBs for OC-48/STM-16 dense WDM transmission systems (from 10 to 40 mW).

Fitel is also premiering a wavelength monitor integrated 1550 nm DFB laser for high-speed, long-haul transmission systems.

In March, Furukawa Electric launched a joint program with Mitsui Chemicals Inc to develop 980 nm pump laser chips (for optical amplification in WDM systems) of high output power and reliability by integrating Mitsui Chemicals' proprietary technology of output power improvement with Furukawa's technology of wavelength and output power stabilisation.

Furukawa Electric has a market share for 1480 nm pump laser modules of 70% (with a production capacity at its plant in the Chiba Works in Ichihara City, Chiba Prefecture, Japan of 100,000 modules per month). After beginning volume production of 250 mW 1480 nm pump lasers last year and 300 mW products this year, at March's ***Optical Fiber Communication*** conference in Anaheim, CA, USA Furukawa exhibited a 400 mW module - the highest in the world (for production by end-2001). This combines a laser chip that uses a newly designed optical waveguide and a package with enhanced heat dissipation efficiency.

Mitsui Chemicals will promote the development and business establishment of 980 nm pump laser chips, and accelerate the development of functional materials for optical communication.

The first product, a 980 nm pump laser chip with a module output power of 250 mW, will be marketed this autumn, followed by a 350 mW module at the beginning of 2002.

Record bandwidth for commercial modulator

CyOptics Inc (Waltham, MA, USA) says its InP-based 40 Gb/s Electra-Absorption Modulators (for production initially in Q4/2001 and in high-volumes in Q 1/2002) are achieving bandwidths in excess of 36 GHz. This is the highest bandwidth among commercial modulators. In contrast, alternative device types for commercial laser modulation, including 40 Gb/s lithium niobate modulators, are specified at bandwidths of 30 GHz or below.